

Electronic Supplementary Information

One-Step Aqueous Solution Synthesis of Ge Nanocrystals from GeO₂ Powders

Jianghong Wu^a, Yangang Sun^a, Rujia Zou^a, Guosheng Song^a, Zhigang Chen^a, Chunrui Wang^b, and Junqing Hu^a

^a State Key Laboratory for Modification of Chemical Fibers and Polymer Materials, College of Materials Science and Engineering, ^bDepartment of Applied Physics, Donghua University, Shanghai 201620, China. E-mail: Hu.junqing@dhu.edu.cn (Junqing Hu), Tel/Fax: 86-21-6779-2947

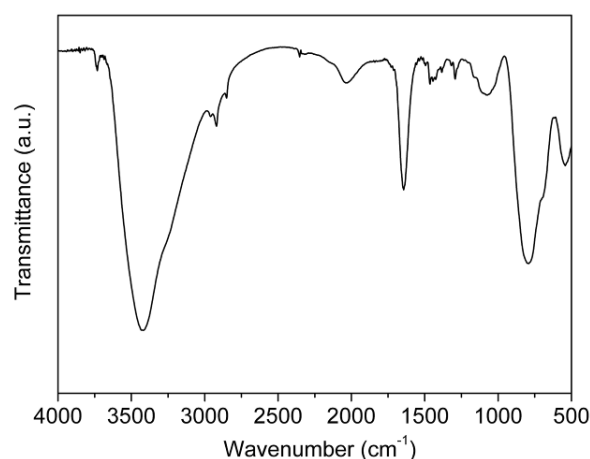


Fig. S1. FTIR spectrum of Ge NCs formed under the most suitable reaction conditions: 60 °C and pH = 7. As we can see, there is an unobvious peak, which vibrates at about 850 cm⁻¹, may result from Ge-O stretch (see Refs. 1, 2). But it is very weaker than frequently observed in GeO₂ material, suggesting minor oxidation of the surfaces of the as-synthesized Ge NCs, which is in accordance with the results from the XRD pattern. The characteristic peaks at ~ 3400 cm⁻¹ and ~ 1630 cm⁻¹ is probably attributed to - OH and - N - C = O, because these Ge NCs were synthesized in aqueous using PVP as a capping agent.

References

1. D. C. Lee, J. M. Pietryga, I. Robel, D. J. Werder, R. D. Schaller, V. I. Klimov, *J. Am. Chem. Soc.* 2009, **131**, 3436
2. E. J. Henderson, C. M. Hessel, J. G. C. Veinot, *J. Am. Chem. Soc.* 2008, **130**, 3624.

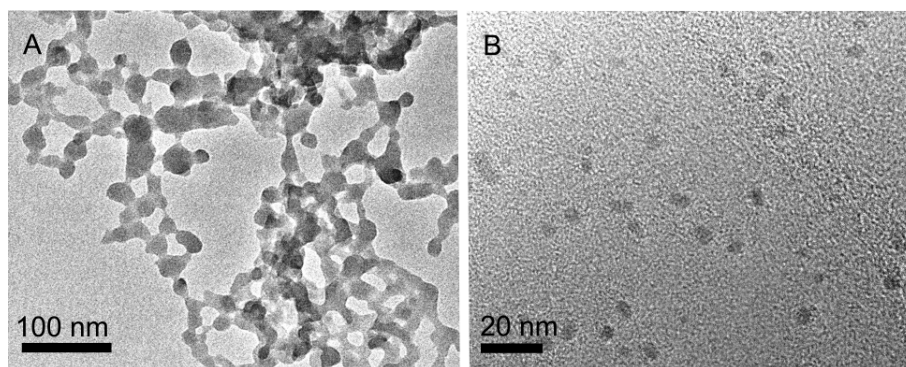


Fig. S2. TEM images of as-synthesized Ge nanomaterials prepared in two different pH conditions: (A) pH = 5, (B) pH = 11. The influence of pH, the reaction time, temperature and surfactants on the formation of the Ge NCs has also been investigated. It was found that a suitable reaction condition is a key factor in the formation of the Ge NCs. When changed the pH of A solution to 5, freestanding Ge NCs can not be formed, as shown in Figure S2 (A); while pH = 11, the size of the Ge NCs is ~ 6-8 nm, a little larger than these obtained when pH is 7 and also not good uniform as when pH = 7, as shown in Figure S2 (B). The Ge NCs were not obtained when the temperature was lower than 60 °C; we explored the temperature decreasing from 50 °C to 30 °C, and reaction time from 2 hrs to 30 min, but no Ge NCs were found by the TEM observation. Meanwhile, various surfactants like CTAB, SDS, PEO-PPO-PEO were tried on this experiment but still could not obtain the Ge NCs.

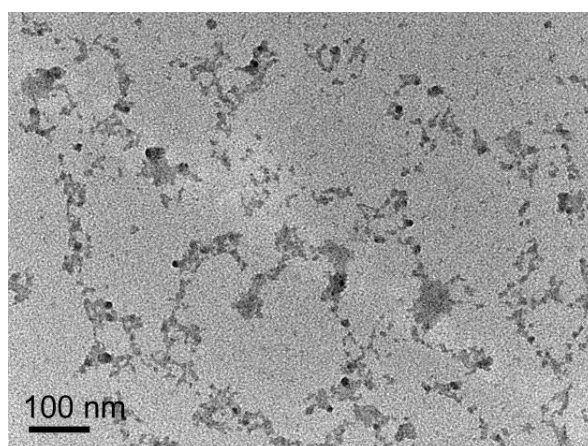


Fig. S3. TEM image of as-synthesized Ge NCs prepared without adding PVP surfactant. The products are aggregative and a good dispersity of Ge NCs can not be obtained.

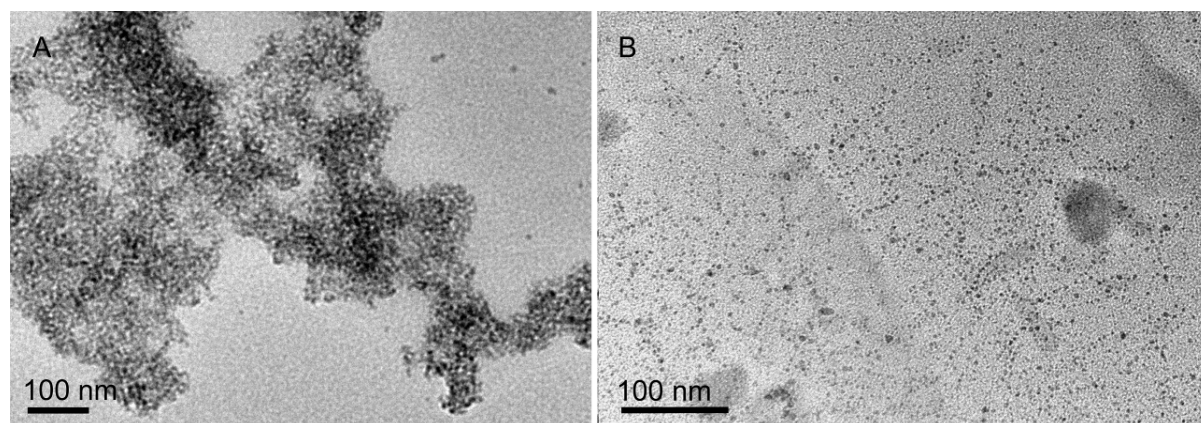


Fig. S4. (A) and (B) The as-synthesized Ge NCs which were not initially irradiated by electron beam.